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70th birthday of Professor Ernest Jucovič

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## 70TH BIRTHDAY OF PROFESSOR ERNEST JUCOVIČ

On August 6th, 1996 Professor Ernest Jucovič celebrated his 70th birthday. He was born in Liptovský Hrádok. Prof. Jucovič graduated from the Faculty of Education of Charles University in Prague (1946–1950). After teaching for one year at a secondary school and working for two years in a publishing house, he continued his teaching career at the High Pedagogical School (later Faculty of Education of the Šafárik University) in Prešov. Since 1966 until his retirement he was a Lecturer and later a Professor at the Faculty of Natural Sciences in Košice. He obtained his Associate Prof. (Docent) degree from the Technical University in Košice (1961), his DrSc. (Doctor of Sciences) in 1974 and became Professor in 1977.

His main scientific interest is in combinatorial geometry and related mathematical areas. He achieved many interesting results on the metric and combinatorial properties of convex polytopes and he studied relations within convex polytopes and between them and related spherical shells. Two of his works are about non-inscribable polytopes. He was later interested in those types of polytopes all of whose vertices can lie on a spherical shell. Self-dual polytopes represent a special field of his interest. In [27], he analyzed the minimal length of a maximal cycle in the graph of convex polytopes with faces of the same type. In papers [17], [21] and [32], he has been dealing with colouring problems in combinatorial structures.

We mention in more detail a topic which was, due to his initiative, intensively studied in Košice, and which received a good international response. Let  $p_k(\mathbf{M})$  or  $v_k(\mathbf{M})$  denote the number of faces or vertices of a decomposition  $\mathbf{M}$  of an orientable 2-manifold of genus  $g$  which are incident with exactly  $k$  edges. Give necessary and sufficient conditions for a pair of sequences  $p = \{p_k \mid 3 \leq k\}$  and  $v = \{v_k \mid 3 \leq k\}$  of non-negative integers for which there exists a decomposition  $\mathbf{M}$  such that  $p_k(\mathbf{M}) = p_k$  and  $v_k(\mathbf{M}) = v_k$  for all  $k$ . The sequence  $p$  is called the face-vector, and the sequence  $v$  the vertex-vector of  $\mathbf{M}$ . (Note that, for  $g = 0$ , by Steinitz's theorem,  $\mathbf{M}$  is combinatorially isomorphic to a 3-dimensional convex polytope if and only if the graph of  $\mathbf{M}$  is 3-connected.) The following conditions for the face-vector and vertex-vector of  $\mathbf{M}$  can be derived from Euler's formula

$$\sum_{3 \leq k} (6 - k)p_k(\mathbf{M}) + 2 \sum_{3 \leq k} (3 - k)v_k(\mathbf{M}) = 12(1 - g), \quad (1)$$

$$\sum_{3 \leq k} (4 - k)(p_k(\mathbf{M}) + v_k(\mathbf{M})) = 8(1 - g). \quad (2)$$

Conditions (1) or (2) do not impose restrictions on the numbers  $p_6(\mathbf{M})$  and  $v_3(\mathbf{M})$  or  $p_4(\mathbf{M})$  and  $v_4(\mathbf{M})$ , respectively. In 1891, a German mathematician Victor Eberhard proved:

If a sequence  $p = \{p_k \mid 3 \leq k \neq 6\}$  of non-negative integers satisfies the condition  $\sum_{3 \leq k} (6 - k)p_k = 12$ , then there is at least one value  $p_6$  such that there exists a convex polytope  $\mathbf{M}$  having every vertex of degree 3, and  $p_k(\mathbf{M}) = p_k$  for all  $k \leq 3$ .

A similar result for 4-valent polytopes has been proved by Branko Grünbaum in 1967. These two results appear to be the first step for solving the following problem: Characterize

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the face-vectors and vertex-vectors of the decompositions of closed orientable 2-manifolds of genus  $g$ . Prof. Jucovič published a number of papers on necessary and sufficient, or only sufficient conditions for the existence of a pair of numbers  $(p_6, v_3)$  (or  $(p_4, v_4)$ ) such that given sequences of non-negative integers  $p = \{p_k \mid 3 \leq k \neq 6\}$  and  $v = \{v_k \mid 4 \leq k\}$  with  $p_6, v_3$  (or  $p = \{p_k \mid 3 \leq k \neq 4\}$  and  $v = \{v_k \mid 3 \leq k \neq 4\}$  with  $p_4, v_4$ , respectively) are the face-vector and vertex-vector of some decomposition. He published the first definitive results about the decomposition of surfaces of genus  $g \geq 1$ . In the proof, new methods and constructions different from planar case have been used. More information can be found in the monograph *Convex Polytopes* [43]. Another study of the decompositions can be found in [36] and [38]. In the first of them, the existence of a nearly regular decomposition with at most two exceptional cells (vertices or faces) was studied. In the second one, he investigated planar decompositions with constant sum of vertices incident with every edge.

Prof. Jucovič was also active in pure geometry – he wrote papers on coverings and packings inspired by the Hungarian geometrical school and in particular by L. Fejes-Tóth. In [39], necessary and sufficient conditions for the existence of packing of domains in the Euclidean plane are given.

Prof. Jucovič achieved several fundamental results in his work, he elaborated constructions, solved famous problems, formulated new problems and showed solutions of some of them. His results are frequently cited, e.g., the monographs of B. Grünbaum, C. Berge and others. Co-authors of some of his works are B. Grünbaum, D. Barnette, J. W. Moon.

After arriving in Košice, Prof. Jucovič created a combinatorial seminar, which became famous both in Slovakia and abroad. He attracted and stimulated a remarkable number of young people whom he helped a great deal in their scientific development.

Prof. Jucovič is not only a scientist – he also dealt with the questions of mathematics education; published a considerable number of expert papers and is a co-author of acclaimed text-books on geometry and methodology.

As a researcher and excellent organizer of research life Prof. Jucovič is known for his great enthusiasm, high demands, and punctuality as well as a deeply human approach towards students and subordinates. Also in this field, his work shows traces of the strength with which he pursues his goal.

On the occasion of his seventieth birthday, we all wish Prof. Jucovič good health, happiness and a long life.

*Marián Trenkler*

## LIST OF PUBLICATIONS BY PROFESSOR ERNEST JUCOVIČ

## Scientific papers

- [1] *Niektoré vlastnosti ortocentier a t'ážisk dvoch trojuholníkov vpísaných do tej istej kružnice.* In: Sborník prác Vyššej pedagogickej školy v Prešove, 1959, pp. 152–157.
- [2] *Umiestnenie 17, 25 a 33 bodov na guli,* Mat.-Fyz. Časopis **9** (1959), 173–176.
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- [4] *Samosoprjažennye K-poliedry,* Mat.-Fyz. Časopis **12** (1962), 1–22.
- [5] *O niektorých vlastnostiach hrán autokonjugovaného K-polyédra,* Mat.-Fyz. Časopis **12** (1962), 203–208.
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- [7] *Zametki o rebrach K-poliedra,* Mat.-Fyz. Časopis **14** (1964), 3–5.
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- [9] *O mnohostenoch bez opísanej gul'ovej plochy I,* Mat.-Fyz. Časopis **15** (1965), 90–94.
- [10] *Über die minimale Dicke einer k-fachen Kreiswolke,* Ann. Univ. Sci. Budapest. Eötvös Sect. Math. **9** (1966), 143–146.
- [11] *O mnohostenoch bez opísanej gul'ovej plochy II,* Mat.-Fyz. Časopis **16** (1966), 226–234.
- [12] *Eine Bemerkung zur Überdeckung der Ebene durch inkongruente Kreise* (with J. Lešo), Mat.-Fyz. Časopis **16** (1966), 224–228.
- [13] *Bemerkung zu einem Satz von E. Steinitz,* Elem. Math. **22** (1967), 39.
- [14] *Beitrag zur kombinatorischen Inzidengeometrie,* Acta Math. Hungar. **18** (1967), 255–259.
- [15] *Poznámka o cestách v štvoruholníkových polyédrických grafoch,* Časopis Pěst. Mat. **93** (1968), 69–73.
- [16] *On polyhedral realizability of certain sequences,* Canad. Math. Bull. **12** (1969), 31–39.
- [17] *On a problem in map colouring,* Mat.-Fyz. Časopis **19** (1969), 225–227.
- [18] *Raumansprühliche Kreispackungen in der euklidischen Ebene,* Mat.-Fyz. Časopis **20** (1970), 3–10.
- [19] *Hamiltonian circuits on 3-polytopes* (with D. Barnette), J. Combin. Theory **9** (1970), 54–59.
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- [21] *Colouring the edges of a multigraph* (with J. Fiamčík), Arch. Math. (Basel) **21** (1970), 446–448.
- [22] *On the number of hexagons in a map,* J. Combin. Theory **10** (1970), 232–236.
- [23] *Toroidal maps with prescribed types of vertices and faces* (with D. Barnette, M. Trenkler), Mathematika **18** (1971), 82–90.
- [24] *On a conjecture of B. Grünbaum* (with S. Jendrol'), Discrete Math. **2** (1972), 35–49.
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- [28] *Analogues of Eberhard's theorem for 4-valent 3-polytopes with involutory automorphisms*, *Discrete Math.* **6** (1973), 249–254.
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- [30] *On the face-vector of a 4-valent 3-polytope*, *Studia Sci. Math. Hungar.* **8** (1973), 53–57.
- [31] *On non-inscribable polytopes* (with B. Günbaum), *Czechoslovak Math. J.* **24** (1974), 424–429.
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- [39] *On packings of circular discs in the euclidean plane with prescribed neighbourhood* (with S. Ševce). In: *Colloq. Math. Soc. János Bolyai 48, Intuitive Geometry, Siófok, 1985*, pp. 289–297.
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- [41] *On quadrangular convex 3-polytopes with at most two types of edges* (with S. Jendrol'), *Discrete Math.* **78** (1989), 297–305.
- [42] *Vertex-vectors of quadrangular 3-polytopes with two types of edges* (with S. Jendrol', M. Trenkler). In: *Combinatorics and graph theory*. Banach Center Publ. Vol. 25, Polish Acad. Csi., Warsaw, 1989, pp. 93–111.
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- [44] *Some constructions of polyhedra of inscribable type* (with S. Ševce, M. Trenkler), *Math. Slovaca.* **47** (1997), 313–317.

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- [52] *Použitie rovnol'ahlosti pri riešení konštrukčných úloh*, *Matematika v škole* **6** (1956), 212–220.
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